

M. Sc. INSTRUMENTATION EXAMINATION, 2024

(1st Year, 1st Semester)

LINEAR CONTROL SYSTEM

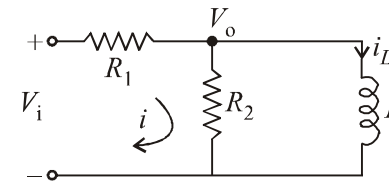
Time : 2 Hours

Full Marks : 80

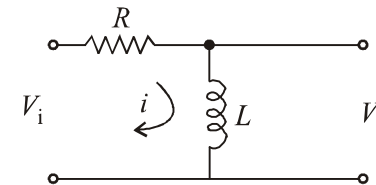
Answer *any four* questions.

All questions carry equal marks 10, Part questions (a) and (b) carry equal 5 marks.

1. (a) Obtain the block diagram of the following circuit in S domain.



- (b) Find the transfer function of the given network below.



(2)

2. (a) With the help of diagram, explain under damped, over damped and critically damped conditions of a system.
- (b) Find the stability of the system having the characteristic equation given by $2s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$.

3. (a) Determine the rise time, peak time, settling time and peak overshoot of a second order control system, which is subjected to a unit step input, where damping factor $\xi = 0.5$ & $\omega_n = 6$ rad/sec.

- (b) A second order system has a transfer function given by

$$G(s) = \frac{25}{s^2 + 8s + 25}. \text{ A step input signal is fed at } t = 0.$$

Find the occurrence of second peak response.

4. (a) Obtain the unit step response of a unity feedback system where open-loop transfer function is

$$G(s) = \frac{4}{s(s+5)}$$

- (b) Find the frequency response of a 1st order system with

$$G(s) = \frac{1}{s\tau + 1}$$

(3)

5. Determine the stability of the following systems whose closed loop transfer functions are given by :

(a) $T(s) = \frac{k(s-1)}{(s^2+4)(s^2+2s+2)}$

(b) $T(s) = \frac{k}{s^3 - 2s^2 + 3s + 6}$

6. Explain PID control mechanism of a control system.

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